(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 May 2001 (10.05.2001)

PCT

(10) International Publication Number
WO 01/32024 A1

(51) International Patent Classification[7]: A21D 13/00, A23G 3/00

(21) International Application Number: PCT/US00/30081

(22) International Filing Date: 1 November 2000 (01.11.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/432,946 3 November 1999 (03.11.1999) US

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/32024 A1

(54) Title: BAKED DOUGH PRODUCTS

(57) Abstract: An improved method of making baked dough products includes baking the dough product without restraints and then compressing the dough product to a desirable thickness. The baking is generally conducted in the presence of steam. The resulting dough products have a dense, chewy texture and sheen. In some embodiments, the dough products are filled dough products that are reheatable in a toaster.

BAKED DOUGH PRODUCTS

BACKGROUND OF THE INVENTION

The invention relates to food products formed with baked dough, and particularly to dough products compressed to form a thin product. The invention further relates to a process for making compressed food products.

A variety of dough products are desirable to consumers, particularly dough products with fillings. Bagel products are a popular and desirable food product with consumers. Consumers desire the dense, chewy texture and the taste of bagel products. In addition, the dough used for making bagel products generally contains low amounts of fat, which is a desirable feature for some consumers. Bagel products with toppings such as cream cheese, peanut butter and fruit toppings are all desirable to consumers. Generally, the toppings are placed on the bagel products just prior to consumption.

While consumers desire food with appealing taste and texture, they also demand food products that are simple and easy to prepare. With respect to ease of preparation, consumers prefer food products that can be stored for long periods of time, e.g. frozen, and that can be reheated quickly prior to consumption. To this end, food products that are toastable are highly desirable to consumers.

SUMMARY OF THE INVENTION

In a first aspect, the invention relates to a baked filled dough product comprising a yeast leavened dough holding a filling. The baked filled dough product having a thickness of between about 10 millimeters and about 20 millimeters.

In another aspect, the invention pertains to a method of making a dough product comprising baking a raw dough composition without restraints and compressing

the baked dough composition to form the dough product. The dough comprises flour, water and an active yeast culture.

In a further aspect, thc invention pertains to a method of making a filled dough product comprising baking a raw filled dough composition without restraints and compressing the baked dough composition to form the dough product. The filling in the filled dough product is substantially held within the dough.

In a further aspect, the invention pertains to a method of making the raw filled dough composition. The method comprises sheeting a dough to produce a top dough sheet and a bottom dough sheet. The dough comprises flour, water and an active yeast culture that have been mixed together. A filling is deposited on the bottom dough sheet. The top dough sheet with vent openings is placed on top of the bottom dough sheet. The combined top and bottom dough sheet composition is crimped and cut to form the raw filled dough composition.

In a further aspect, the invention pertains to a method of making a dough product comprising baking the dough product in an impingement oven with air nozzles wherein steam is injected in one or more zones of the impingement oven through the air nozzles.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram showing the top and two sides of a toaster-sized filled dough product.

Fig. 2 is a sectional view of a multizone impingement oven.

Fig. 3 is a sectional view of a compression apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An improved process for making dough products has been discovered. The improved process includes baking raw dough compositions without restraints and then compressing the baked composition to form the desirable dough products. In some embodiments, the dough products made by the improved process can have a dense, chewy texture and an exterior sheen which are features commonly associated with bagels and other desirable dough products. The dough products are made from a raw dough composition that generally includes a leavening agent. In some embodiments, the dough products contain a filling. In addition, some embodiments of the dough products are appropriately sized for reheating in a standard popup toaster.

Dough products described herein can be similar to, for example, bagels, soft pretzels, french bread, rye bread, sticky buns and the like. These dough products may, optionally, be filled dough products. In some embodiments, the dough products can have a dense, chewy texture and an exterior sheen. The dough used to make the dough products generally includes flour, water and a leavening agent, preferably an active yeast culture. The dough may also include other optional ingredients, for example, sweeteners, flavorings, and fat products. The dough products can be filled with a variety of fillings. Preferable fillings are substantially retained within the dough crust during the processing steps.

In some embodiments, the dough products are bagel-like products with the dense, chewy texture and an exterior sheen. These bagel-like dough products will be referred to herein as bagel products. Generally, the bagel products are filled bagel products.

The dough products described herein can be prepared from a bucky dough. A bucky dough generally has a farinograph measurement of greater than about 1000 Brabender units (BU). The farinograph measurement is dependent on the amount of flour, the type of flour and the amount of water. Large amounts of gluten in the dough, for example, can increase the buckiness of the dough. Plasticizers such as shortening present in the dough can also influence the farinograph measurement. Increases in the amount of water and/or plasticizers decreases the buckiness of the dough.

The extensibility of a dough can be measured by an extensigraph. An extensigraph can measure the mechanical properties of a dough, for example, the elasticity and the plasticity of the dough. Using an extensigraph, the R_{max} and the R_5 can be measured. The R_{max} relates to the maximum force necessary to break the dough. The R_5 relates to the force necessary to pull the dough 5 centimeters. The dough products described herein may have an R_{max} between about 700 and about 1000 and an R_5 of less than about 1000.

In some embodiments, the dough products can have a low fat content. By low fat, it is meant that the dough product generally has less than about 3 grams of fat per serving. The size of a serving is as presently defined by the United States Food and Drug Administration. Generally, each of the dough products are sized to be one serving. In particular, the dough crust of the filled product can have a low fat content. The fat content of the filled dough product can obviously increase depending on the nature of the filling.

The dough products are generally completely cooked and refrigerated or frozen for storage and distribution. The refrigerated or frozen dough products can be

reheated in a number of ways prior to consumption. The dough products can be advantageously made to fit into a standard pop-up toaster. The dough products can be sufficiently thin to not only fit in a toaster but also to be appropriately reheated in a toaster, i.e. all of the product including the filling, if present, can attain a desirable temperature.

The raw dough compositions described herein preferably are baked without any restraining devices. Preferably, steam is used during at least part of the baking regimen. Baking the dough products without any restraining devices is particularly advantageous because the dough is allowed to expand completely, i.e. take a natural course of expansion during baking. Baking without restraining devices however, can result in a fairly thick product that is inappropriately sized for reheating in a toaster.

Surprisingly, the baked dough compositions can be compressed, often assisted by the presence of vent openings to produce the dough products described herein. The baked dough compositions, particularly the baked dough compositions without filling, may be compressed even in the absence of vent openings. In the absence of vent openings, the compressed dough product however, may become undesirably wrinkled. Preferable dough compositions include vent openings. Compression of the baked dough composition to a desired thickness can be performed after the baking regimen without destroying the desirable textural features of the dough products.

A variety of ways can be used to generate the raw dough compositions. The dough can be sheeted, extruded and the like to obtain a desirable shape and size. Raw dough compositions without filling can be produced, for example, by cutting a sheeted dough to a desired shape and size.

In particular, sheeted dough can be used to generate the raw filled dough compositions. In some embodiments, the dough, with a leavening agent, is prepared and then sheeted. The sheeted dough can then be cut in half to produce a bottom dough sheet and a top dough sheet. The filling can be spot-deposited on the bottom dough sheet and optionally sprayed with water. Spraying water on the bottom pad results in a bottom dough sheet that is appropriately tacky when the top dough sheet is placed on the bottom dough sheet.

The top dough sheet generally includes openings for venting. Suitable openings include slits, holes, cross-hatched areas and the like. Preferably, the openings are sized and shaped to substantially retain the filling while providing venting. Some filling however, may leak out during some of the processing steps. The top dough sheet with the vent openings can then be placed on the bottom dough sheet with the filling. The combined composition can then be crimped and cut to produce the raw filled dough composition.

The raw filled dough composition can then be proofed. Proofing yeast leavened dough generally involves providing appropriate conditions for fermentation to occur. Proofing yeast leavened dough results in desired organoleptic properties, for example smell and flavor, after baking. During proofing, the dough expands in volume, i.e. the dough becomes less dense, due to fermentation of sugars by the yeast and the resulting carbon dioxide. Other substances produced during fermentation modify the elasticity, stickiness and the flow properties of the dough. After proofing, the composition can be baked and compressed as described above.

DOUGH

A dough minimally includes flour, a liquid component and a leavening agent. Other ingredients can be included in the dough such as fat components, salt, sweeteners, dairy products, egg products, emulsifiers, other flavorings and the like. Suitable flours include glutinous flours, nonglutenous flours and combinations thereof. If nonglutenous flour is used, a sufficient amount of glutinous flour, gluten, and/or gluten-by-products may be included in the dough. Preferred flours include, for example, wheat, corn, rye, barley, oats, sorghum and tritiacale. The flours can be whole grain flours, flours with the bran and/or germ removed, or combinations thereof. Generally, the dough includes between about 30% by weight and about 70% by weight of flour, preferably from about 45% to about 60% percent by weight flour, and more preferably from about 50% to about 55% by weight flour.

The dough can also include one or more liquid components. Suitable liquid components include for example, water, milk, and oil. A combination of liquid components may also be used such as milk/water, water/oil and the like. Preferably, the liquid component includes water. Liquid components can generally be added to the flour and any other dry ingredients that may be used. The amount of liquid components added is dependent on the desired moisture content of the dough. Preferably, the amount of liquid components is between about 15% by weight and about 35% by weight, more preferably between about 20% by weight and about 30% by weight.

The dough can optionally include egg products. Suitable egg products include for example, fresh eggs, egg substitutes, dried egg products, frozen egg products. The amount of egg products, if used, can be between about 0.1 percent by

weight and about 35 percent by weight. The egg products may be in a dried form or a liquid form. If a liquid form of an egg product is used, the amount of liquid component is adjusted to take into account the moisture content resulting from the liquid egg product.

The dough can optionally include dairy products. Suitable dairy products include, for example, milk, milk products, buttermilk and buttermilk products. Additionally, milk substitutes such as soy milk may also be used. If used, dairy products can be up to about 25 percent by weight of the dough. Preferably, the dairy products are between about 1 percent and about 10 percent of the dough.

The dairy products may be added in a liquid form or in a dried form. Liquid milk can be added during preparation of the dough. If liquid dairy products are used, the amount of other liquid components, if any, are adjusted accordingly. Alternatively, dried milk products may also be used during dough preparation.

The dough, optionally, can include fat ingredients. Preferred fat ingredients include, for example, oils and shortenings. Suitable oils include, for example, soy bean oil, corn oil, canola oil, sunflower oil and other vegetable oils. Suitable shortenings include, for example, animal fats and hydrogenated vegetable oils. The dough, preferably does not contain any added fat. If added, the fat generally is less than about 15 percent by weight, preferably between about 0.2 percent by weight and about 6.0 percent by weight, more preferably between about one percent by weight and about 5 percent by weight. If liquid oils are used, the amount of other liquids is adjusted accordingly.

Furthermore, the dough can include, optionally, a sweetener and/or artificial sweetener. Suitable sweeteners include dry sweeteners and liquid sweeteners.

If liquid sweeteners are used, the amount of other liquids is adjusted accordingly. Suitable dry sweeteners include, for example, lactose, sucrose, fructose, dextrose, maltose, corresponding sugar alcohols, and mixtures thereof. Suitable liquid sweeteners include, for example, high fructose corn syrup, malt and hydrolyzed corn syrup. In preferred embodiments, the dough includes between about 2% by weight and about 15% by weight, in more preferred embodiments between about 5% by weight to about 10% by weight sweetener and in even more preferred embodiments between about 7 percent by weight and about 8 percent by weight sweetener.

The dough can further include additional flavorings, for example, salt, such as sodium chloride and potassium chloride, whey, malt, yeast extract, inactivated yeast, spices and vanilla. The additional flavoring preferably comprises from about 0.1 percent to about 10 percent of the dough. And more preferably from about 0.2 percent to about 5 percent of the dough.

The dough can optionally include particulates. Suitable particulates include for example, raisins, currants, fruit pieces, vegetable pieces and the like. In a preferred embodiment, the dough includes raisins.

The dough can optionally include emulsifiers, preservatives and conditioners. Suitable emulsifiers include lecithin, mono- and diglycerides, polyglycerol esters and the like. Preferably the emulsifiers are diacetylated tartaric esters of monoglyceride (DATEM) and sodium stearoyl-2-lactylate (SSL). DATEM can enhance gas retention by bonding to hydrated gluten strands and improving extensibility and resiliency of dough. SSL can enhance gas retention less effectively than DATEM but it can also bind to amylose leading to crumb softening and shelf life extension. Suitable conditioners can include for example, azodicarbonamide, potassium sulfate,

L-cysteine, sodium bisulfate and the like. Conditioners can make the dough tougher, drier and easier to manipulate. Preferably the azodicarbonamide is not morc than 45 parts per million.

Filling

In some embodiments, the dough products are filled dough products. The types of fillings suitable for the dough products herein include fillings described in U.S. Patent No. 4,612,198 and U.S. Patent No. 4,623,542 which arc incorporated herein by reference. Preferable fillings for the dough products include the properties described below.

The filling used in the filled dough products described herein can be a raw or cooked food product. The filling and/or ingredients of the filling can be previously frozen and subsequently thawed and/or cooked. The filling can have a uniform consistency or a chunky consistency. If the filling includes chunks, the chunks are small enough that they do not deform the food product during the compression stage. In preferred embodiments, the filling is a highly viscous liquid, suspension or a flowable mixture of particulates and/or liquid that may not normally be a liquid or a suspension. The material preferably is highly viscous such that it will not flow immediately through any imperfection in the dough or out of the seams.

The filling can be made from any type or types of food ingredients, including meat ingredients, vegetable ingredients, dairy ingredients, fruit ingredients, spices, flavorings, fats and the like. Suitable fillings include cream cheese, cinnamon, fruit fillings, peanut butter and the like. The filling can further include property modifiers, for example, fat components, starches, stabilizers, preservatives and the likc.

Fruit fillings generally comprise fruit or fruit derivatives, sweeteners, water, fat components, starches, stabilizers, and flavors. A wide variety of fruit jelly filling compositions and flavors can be used in the dough products described herein. There is no specific limitation on many of the ingredients of the filling composition. An appropriate combination of ingredients can be used to develop the desired sweetness-tartness combination as well as the specific flavors, such as grape, strawberry, raspberry, cinnamon, cherry, blueberry, or the like.

The filling used in the dough products described herein generally has a water activity that is similar to or lower than the water activity of the dough. The water activity of the filling is preferably between about 0.79 and about 0.90, and more preferably between about 0.82 and about 0.87.

Water activity can be determined as $a_w = p/p_o = ERH/100$, where p is the partial pressure of water above a sample, p° is the vapor pressure of pure water at the same temperature, ERH is the equilibrated relative humidity (%) surrounding the product. A lower water activity filling generally has high bake stability so that the filling will not boil out during the cooking process. A filling with water activity significantly higher than the dough can cause moisture migration to the dough and result in a soggy product, thus compromising the product quality.

The viscosity of the filling can be measured by a Brookfield "HB" viscometer with a LV#2 cylindrical spindle at all the RPMs. The viscosity of the filling, at a shear rate of about 1 rpm and at about 70°F, used is generally between about 100,000 centipoise (cps) to about 400,000 cps, preferably between about 175,000 cps to about 350,000 cps.

Obtaining a desired viscosity range can be accomplished by controlling the starch levels and the stabilizer levels in the filling composition, with sufficient amounts being added to achieve the specified viscosity ranges. The starches can include cook up starches and/or pre-gelatinized starches. Suitable starches include modified wheat starch, modified corn starch, modified potato starch, modified tapioca starch and the like. The filling generally has starch levels between about 5 percent by weight and about 9 percent by weight. Preferably the filling has a starch level between about 6 percent by weight and about 8 percent by weight, and more preferably between about 6 percent by weight and about 7 percent by weight.

In addition to starches, stabilizers may also be included in the filling to acquire the desired viscosity and physical properties. Stabilizers can include for example, gums and proteins. Suitable gums include gellan gum, xanthan gum, guar gum, carob bean gum, locust bean gum and the like. If used, the filling generally has a gum level of less than or about 0.8 percent by weight, and preferably between about 0.4 percent by weight and about 0.6 percent by weight. Proteins can also be used as stabilizers. Suitable proteins include dairy proteins such as whey and casein, egg proteins and gelatin.

In addition to viscosity, the pH range of the filling may also be adjusted, particularly in fruit fillings, to the desired level with respect to taste. Generally, the pH of the filling can vary over a range between about 2.8 to about 7.5. Fruit containing, fruit flavored and other acidic type fillings generally can have a pH between about 2.8 to about 4.5, preferably between about 3.4 to about 4.2 and more preferably between about 3.5 to about 4.1.

Fat components may be included in the filling, in addition to any inherent fat present in the other ingredients, to improve the textural and sensory attributes of the filling and thus, the dough product. It has also been discovered that addition of a fat component can aid during the processing of the dough products. In processing, the filling may leak out through the vent openings during compression. In particular, addition of a fat component can reduce the stickiness of the filling to the compression apparatus during compression. Alternatively, fillings without any fat are also suitable for use in the dough products described herein.

The fat content of a filling is generally less than about 25 percent by weight. The fat content of a filling is preferably between about 1 percent by weight and about 15 percent by weight, more preferably between about 2 percent by weight and about 10 percent by weight. Suitable fats that can be added to the filling can include for example, oil, shortening, butter and the like.

Table 1, table 2, and table 3 show typical formulations of blueberry filling, strawberry filling and cinnamon filling, respectively.

TABLE 1

Ingredient	% by weight
Corn Syrup	36.17
Water	27.23
Sugar	8.81
Blueberries	2.74
Dextrose	9.79
Viscosity controlling agents (mod. corn & tapioca starches, gums, and fibers)	8.9
Blueberry juice conc.	2.79
Part. Hydrog. Veg. Oil	2.06
Buffering system	0.20
Flavoring	0.28
Preservatives	0.44
Artificial coloring	0.59
Total	100.00

TABLE 2

Ingredient	**% by weight**
Corn syrup	33.16
Water	22.42
Sugar	21.29
Strawberries	7.65
Viscosity controlling agents (mod. corn & tapioca starches, gums, and fibers)	8.71
Strawberry juice conc.	3.18
Part. Hydrog. Veg. Oil	2.00
Flavoring	0.80
Buffering system	0.20
Preservatives	0.42
Artificial coloring	0.17
Total	100.00

TABLE 3

Ingredient	% by weight
Water	25.58
Corn syrup	24.78
Sugar	16.85
Dextrose	14.70
Viscosity controlling agents (mod. tapioca starch, gums, and fibers)	5.69
Cinnamon	1.00
Molasses	0.81
Buffering system	0.20
Buffering system	0.15
Preservatives	0.44
Artificial coloring	0.59
Total	100.00

Dough products

The size of the dough products described herein can vary. The size of the dough product is dependent on the consumer desirability, method of reheating, and processing and packing needs. A dough product that is intended to be reheated in a toaster has to be sized to fit into a toaster and attain the desired temperature in the toaster upon reheating. The shape of the dough products can also vary. The dough products, for example, can be rectangular, circular, ovoid and the like. In addition, shapes such as animal shapes or other desired shapes can also be generated. Fig. 1 shows a filled dough product 50 with venting slits 52 in which the dough has a dense, chewy texture and sheen similar to a bagel.

In preferred embodiments for toaster reheating, the filled dough products generally have a thickness between about 10 mm and about 20 mm, preferably between about 12 mm and about 18 mm, and more preferably between about 14 mm and about 16 mm. The filled dough products can have a length between about 3.6 inches and about 4.4 inches, preferably between about 3.8 inches and about 4.2 inches, and more preferably between about 3.9 inches and about 4.1 inches. Thc filled dough products can have a width between about 2.6 inches and about 3.4 inches, preferably between about 2.8 inches and about 3.2 inches, and more preferably between about 2.9 inches and about 3.1 inches.

In some preferred embodiments of toaster-sized products, the filled dough products generally weigh between about 45 grams and about 53 grams, preferably between about 47 grams and about 51 grams, more preferably between about 48 grams and about 50 grams. In some embodiments, the filled dough products generally contain less than about 3 grams of fat per serving, preferably between about 0.1 grams per serving and about 2.5 grams per serving, and more preferably between about 1 grams per serving and about 2 grams per serving.

Preparation of the dough

To produce the desired dough products, a raw dough composition is first produced. The raw dough composition can then be baked, preferably without any restraining mechanisms. Baking without restraints allows the composition to expand in a natural course and allows the dough product to acquire the desirable dense, chewy texture and sheen. After baking, the composition can be compressed to the desired thickness. Compression allows sizing of the product, in terms of thickness, for toastability while retaining the dense, chewy texture and the surface sheen.

The dough includes flour, water and a leavening agent, preferably a yeast leavening agent. To use a yeast leavening agent, active yeast compositions, for example, active dry yeast, can be hydrated to form a yeast slurry that is in turn incorporated into the flour to form the dough. In a yeast slurry, generally the yeast is substantially dispersed without any undesirable lumps. The yeast slurry is generally mixed, tumbled or agitated in a suitable manner to prevent the yeast from settling to the bottom.

The active dry yeast can be hydrated by adding the yeast to warm water that can increase the yeast activity. The water is generally between about 90°F and about 120°F. Preferably the water is between about 95°F and about 115°F, more preferably between about 100°F and about 110°F. The yeast can be added to the warm water slowly while mixing. Preferably the yeast and the warm water are mixed between about 10 minutes and about 30 minutes. The mixing also can remove any undesirable lumps and can keep the yeast well dispersed in the liquid to prevent the yeast from settling. A suitable mixing system, for example, is a tank with a Lightnin™ mixer from Lightnin in Rochester, NY.

The yeast slurry, the liquids, the ice and the dry ingredients can be mixed together in a variety of ways. In some embodiments, a liquid and ice slurry is made by combining the yeast slurry, water, any other liquid ingredients, and ice. The liquid and ice slurry may be prepared in a tank. In particular, water and ice are combined with the yeast slurry to form the liquid and ice slurry. Generally, the added water is between about 36°F and about 40°F. Suitable forms of ice include for example, ice chips, ice shavings and the like.

Additional ingredients that are in a liquid form and that can be added to the liquid and ice slurry include, for example, sweeteners and malt. In some embodiments, high fructose corn syrup (HFCS) is added in liquid form. Preferably the HFCS is added at a temperature where it will not crystallize. The HFCS and malt are preferably warmed to between about 90°F and about 100°F prior to being added to the liquid and ice slurry.

The liquid and ice slurry is generally mixed in a vessel with a mixer, an agitator or the like. The slurry may be mixed at a fairly high agitation. A suitable mixing system for example is a tank with a Lightnin™ mixer purchased from Lightnin in Rochester, NY. The slurry, after the yeast slurry and all the liquid and ice have been added and mixed, is generally between about 25°F and about 40°F, preferably between about 30°F and about 34°F, and more preferably about 32°F.

The liquid and ice slurry can then be transferred to a dough mixer. A dough can be formed by mixing the dry ingredients, which are generally front loaded into the mixer, with the liquid and ice slurry. Preferably, the dry ingredients do not include salt. A fat component can optionally be included. The fat component can be in a plastic form, i.e. a solid shortening, that has been softened. If liquid fats are used, the fats can be added to the liquid and ice slurry. Generally, the flour and any other dry ingredients are combined with the fat component, if used, and then added to the liquid and ice slurry.

The dry ingredients, the liquid and ice slurry and the optional fat components are mixed to form a dough. Mixing of the dough may be performed for example, by a horizontal bar mixer with a cooling jacket. A farinograph and extensigraph are preferably used to verify the flour/water ratio and dough development.

A suitable mixer is a 2500 lb. horizontal bar mixer from Oshikiri in Japan. The dough is generally mixed between about 5 minutes and about 45 minutes, preferably between about 10 minutes and about 20 minutes and more preferably between about 14 minutes and 16 minutes. The target temperature for the resulting dough is generally between about 60°F and about 80°F. Preferably the temperature of the dough is between about 66°F and about 70°F and more preferably about 68°F.

Preparation of the raw dough composition

The dough described herein can be used to make a variety of raw dough compositions. In preferred embodiments, a raw filled dough composition that includes a filling that is surrounded by the dough is produced. A variety of methods can be used to make the raw filled dough composition.

In a preferred embodiment, the raw filled dough composition is made by sheeting the dough and using the sheeted dough to form the filled composition. The dough can be separated into smaller portions referred to herein as "chunked dough". The chunked dough can be presheeted and used to initiate the sheeting process to form a continuous sheet of dough. Presheeting is generally performed in order to create a continuous dough slab of consistent thickness to begin the sheeting process. The actual thickness of the dough slab is not critical as long as the thickness is consistent as the dough enters the sheeter. The dough, in the sheeting apparatus, is compressed to form sheeted dough of a desired size.

In the presheeting process, the chunked dough enters the presheeter, preferably via an internal conveyor. As the dough exits the presheeter, a dough sheet preferably with even ends and consistent thickness is produced. The presheeter can include a corrugated top roller and a smooth bottom roller.

The presheeted dough can be passed through sheeting rollers to generate dough sheets with a desired thickness. The final thickness of the dough sheet can vary but is generally between about 1.5 mm and about 5 mm, preferably between about 1.8 mm and about 4 mm, and more preferably between about 2.0 mm and about 3.0 mm.

To make the raw filled dough compositions of some embodiments described herein, a top dough sheet and a bottom dough sheet are generally made. The two dough sheets may be generated from two different sheets. Alternatively, one dough sheet may be generated that is appropriately wide such that the sheet is then cut in half to generate the top dough sheet and the bottom dough sheet.

The sheeting process can include a number of rolling steps. The rolling steps may be interspersed, optionally, with enrobing steps and/or lapping steps. The rolling step generally involves the dough traveling between rollers which results in flattening and expanding of the dough. The rolling steps may involve sets with two rollers, three rollers or optionally more than three rollers.

The enrobing step is generally performed in order to add particulates or fat to the dough. In enrobing, the particulates are added to the surface and then the dough part of the dough sheet is folded over the particulates and rolled. In some embodiments, addition of particulates may be desirable. Generally, additional fat is not added to embodiments of bagel products. The enrobing step preferably does not involve adding any additional fat components.

Sheeting can also include lapping steps. Lapping steps can involve changing the direction in which the dough is worked. Lapping is preferable with doughs having a farinograph measurement of greater than about 1000 BU. Lapping in these doughs reorients the polymers, i.e. proteins, thus, reducing dough snapback. Preferable

sheeting protocols using doughs described herein have lapping steps. Lapping steps may also be used for addition of plasticizers such as shortening.

For sheeting, the dough is generally rolled through at least one set of rollers. Additional sets of rollers are preferable for gradually increasing the size of the dough sheet and decreasing the thickness of the dough sheet to the desired thickness. Example 2 describes one particular method of producing a dough sheet.

For rolling steps, a gap setting between each set of rollers can be selected. The gap setting generally decreases gradually in the rolling steps between entry into a sheeter and exit from a sheeter. The gap settings can vary depending on the number of rollers used and may depend on the properties of the particular dough.

Any particulates are generally added during the sheeting process, particularly during the enrobing step. The particulates may also be added to the dough during formation of the dough. However, particulate damage may be high if added during dough formation compared to addition of particulates in an enrobing step. The dough is preferably passed through a set of rollers and then the particulates are layered on the dough, preferably in the center third of the dough sheet and folded. The dough can then be further processed through additional rollers and/or lappers.

The presheeter, the lappers and rollers in the sheeter may be coated with release agents such that the dough will release at the appropriate points without deforming. Release agents can include for example, flours, starches and the like. Preferably a light, even and consistent coating of the release agent is applied to the rollers or lappers. After removal from the rollers, the dough sheets may be dedusted to remove any excess release agents. Dedusting may be performed by brushes designed to remove excess release agents from the surface of the dough sheets.

The raw filled dough composition can be assembled using the dough sheets. A top dough sheet and a bottom dough sheet can be generated. In some embodiments, the dough sheet is cut in half to generate the top dough sheet and the bottom dough sheet. The filling can be deposited on the bottom dough sheet. The filling is generally spot deposited with appropriate spacings for crimping and cutting the combined composition into the single raw filled dough compositions. The spot deposited fillings are preferably at the center and away from the edges of the eventual raw filled compositions. Each raw filled composition can contain a single filling. Alternatively, each raw filled composition may contain a plurality of fillings.

In some preferred embodiments, each raw filled composition has two fillings. Suitable combinations for example, include a combination of cream cheese/fruit filling or a combination of cream cheese/cinnamon filling. The combinations are preferably at a ratio of about 1:1 by weight. Various ratios may be preferable depending on the combination used.

In embodiments with more than one filling, the filling can be deposited in a variety of patterns. Suitable patterns for depositing filling include for example, a strip pattern and a band pattern. In a strip pattern, the strips of filling are placed side by side. In some embodiments, a three strip pattern is used. Of the various types of fillings to be used, the center strip is preferably the filling that is less prone to boil out during cooking and/or less prone to stick to the compression apparatus during compression. In a band pattern, the fillings are placed on top of each other. With two fillings, two bands of filling generally are used. The bottom band is preferably the filling that is more prone to boil out during cooking.

The fillings can be placed on the bottom dough sheet using a variety of devices including devices that can pump the filling. Preferable devices pump and place the filling at the appropriate spot. A suitable device for pumping the filling includes a Graco piston pump by Graco, Minneapolis, MN. Suitable devices for depositing the filling include a rotary depositing system from Fedco in Odessa, FL. and a piston depositing system from Hinds-Bock in Redmond, WA.

After the filling is deposited, the top dough sheet can be placed on the bottom dough sheet. The top dough sheet preferably contains vent openings through the thickness of the dough. The size of the vents can vary but are generally between about 0.8 inches and 1.5 inches wide, preferably between about 0.9 inches and about 1.3 inches wide, and more preferably between about 1.0 inches and about 1.2 inches. The number of vents can also vary per dough product. Preferred dough products have three venting slits in a diagonal orientation.

The surface area of the vent openings is generally at least about 0.14 square inches. The surface area of the vent openings is generally sufficient to prevent puffing of the dough composition during baking. A puffy baked composition can result in an undesirable wrinkled product after compression. Inappropriately large venting surface area can result in excessive leakage of the filling. The optimal surface area of the vent openings can vary depending on the type of baking chamber and the air flow in the baking chamber.

The vents are preferably played in the top dough sheet following deducting of the top dough sheet. The vents preferably do not extend over the entire width or length of the product. The vents on the raw filled composition generally are centered in the middle of the composition. The edges, preferably about half-inch at each

side, do not contain vents. The vents can be venting slits, holes, cross-hatched areas and the like. Preferably, about three venting slits occur for each raw filled composition. Diagonal venting slits are preferable since they are more visually pleasing to the consumer. The vents are generally centered over the fillings when the top dough sheet is placed over the bottom dough sheet. The vents preferably remain open during baking.

After the top dough sheet and the bottom dough sheet are combined, the combination can be crimped and cut to form the raw filled dough composition. The adhesion between the dough sheets can be improved by providing water at the seams between the dough sheets prior to crimping and cutting. The dough sheet combination may be side crimped, end crimped, end cut and/or side cut to form the ends and sides of the raw filled dough composition. Crimping generally involves pressing two sheets, usually the edges, together to form a seal.

Suitable implements for side crimping may include rotary crimper wheels. Preferably the side crimper wheels provide smooth and rounded sides. A blunt, flat crimp however, is also within the scope of this invention. Suitable implements for end crimping may include a crimping bar. The end crimping also preferably leaves a smooth and rounded edge. Suitable crimpers may be obtained from dough equipment manufacturers such as Moline in Duluth, MN. and Rademaker in Culemborg, Netherlands.

The raw filled dough composition can be suitably sized to fit into a standard pop-up toaster. The length of the raw filled dough composition can be between about 3.5 inches and about 5.0 inches, preferably between about 3.8 inches and about 4.5 inches and more preferably between about 3.9 inches and 4.2 inches. The width of the raw filled dough composition can be between about 2.0 inches and 4.0 inches,

preferably between about 2.5 inches and 3.5 inches and more preferably between about 2.8 inches and 3.2 inches. The thickness of the raw composition is preferably between about 0.27 inches and about 0.59 inches and more preferably between about 0.35 inches and about 0.36 inches.

Proofing and baking the raw filled dough composition

After the raw filled dough compositions have been assembled, they are proofed. The proofed compositions are generally sprayed with water and baked.

In some embodiments, heat is applied to the bottom of the raw dough compositions before or as they are conveyed into a proofer. This preheating can improve the efficiency of the proofing and can reduce the sticking of the raw dough composition to the conveyor belt thus, improving transfer of the raw dough composition to various sites. A suitable method for applying heat to the raw dough composition is by the use of a belt grill associated with the conveying belt directed into the proofer. Other methods include passing the conveying belt over a heat source or using other heated conveying belts.

The amount of heat applied to the bottom surface of the raw dough composition can vary. The heat is generally sufficient to dry the bottom of the dough without excessively browning or burning the bottom surface. Preferably, the raw dough composition is heated to a point at which the dough structure sets and can no longer stick to the belt. Heating of the dough also improves proofing efficiency since the dough only expands in directions where the dough structure is not set.

The lower surfaces of the raw dough compositions can be exposed to temperatures of between about 100°C and about 300°C for up to about 60 seconds. Preferably, the raw dough compositions were exposed to temperatures of between about

150°C and about 200°C for between about 10 seconds and about 30 seconds. More preferably, the raw dough compositions were exposed to temperatures of between about 170°C and about 180°C for between about 13 seconds and about 17 seconds.

The raw filled dough composition can be proofed which allows the leavening agent to activate. The proofer preferably can proof compositions with a yeast leavening agent. The proofer generally includes a warming unit that is enclosed with humidification and air flow. Proofing can be performed in a variety of proofing units. Suitable proofing units are supplied, for example, by Frigoscandia Equipment, Redmond, WA., Northfield Freezing, Northfield, MN., and Triphase, West Yorkshire, U.K. The proofer may be a spiral proofer in which the proofing compositions travel on a proofing belt that is in a spiral configuration within the proofer. The proofer may also include two zones. The two zones may contain same or different conditions. The proofing belt preferably is a tightly woven mesh such that the dough of the proofed composition can not sag into the mesh and stick to the proofer belt.

The proofing can be performed between about 80°F and about 115°F, preferably the proofing is performed between about 85°F and about 110°F, and more preferably between about 90°F and about 105°F. The proofing can be performed at a relative humidity between about 40% and 95%, preferably between about 45% and about 85% and more preferably between about 50% and about 60%. The proofing is generally performed for between about 20 minutes to about 45 minutes, preferably between about 25 minutes to about 40 minutes and more preferably for between about 28 minutes and about 38 minutes.

Prior to baking, the top surface of the proofed composition can be coated with water to further facilitate the development of the desired texture and sheen

attributes. Coating the proofed composition is preferably done by spraying water onto the proofed composition. Suitable implements for spraying the water include a spray nozzle and other implements capable of atomizing water. The proofed composition may be dipped in water. However, dipping can result in a sticky product that is easily malformed during further handling. The amount of water sprayed can vary. Preferably between about 0.8 gram of water and about 1.2 gram of water is sprayed per composition and more preferably between about 0.9 gram and about 1.0 gram of water is sprayed per composition.

Generally, the proofed composition is treated with water in an area that is spatially close to the entry point of the baking chamber. Delay in entry into the baking chamber after treatment with water can lead to soaking of the water into the dough and altering of the desirable crust characteristics. Additionally, because of the water on the top surface, the moistened composition can be prone to sticking.

The proofed composition can be transferred to a baking surface, if necessary. The baking surface that holds the composition during the baking may optionally be treated with a non-stick substance. The baking surface is preferably part of a conveyor belt system. The non-stick substance for the baking surface preferably is oil, and the oil is preferably applied in a continuous manner to the baking surface. The amount of non-stick substance used can vary and is dependent on the stickiness of the particular dough. Generally, the baking surface is lightly coated.

The proofed composition can then be baked in a baking chamber. Suitable baking chambers include conventional ovens, convection ovens, impingement ovens and the like. Preferably, the compositions are steam baked using a baking chamber with an inlet for moist air, i.e. steam. In some embodiments, steam baking is

preferable in order to achieve the desired texture and sheen attributes. Steam injection can keep the composition in a moist environment and can aid in delaying setting of the top, outer structure of the dough product. This can allow the dough product to spread laterally instead of forming an outer shell.

In some embodiments, the baking chamber is a conventional rack oven with steam injection preferably through steam coils. A suitable rack oven can be obtained, for example, from Gemini Bakery Equipment Co. in Philadelphia, PA. In other embodiments, the baking chamber is preferably an impingement oven with sufficient steam injection to obtain dough products with desirable attributes. Suitable impingement ovens can be obtained from, for example, the Enerjet impingement oven supplied by APV, Grand Rapids, MI., Meincke Turbu impingement oven supplied by SASIB, Copenhagen, Denmark, and Enersyst impingement oven from Stein, Sandusky, OH. Impingement ovens typically do not have sufficient amounts of steam to provide the desired texture and sheen attributes. Surprisingly, an environment with sufficient amount of steam to obtain the appropriate sheen and texture can be created within an impingement oven by injecting steam through the air nozzles.

A sectional view of a suitable impingement oven 100 is shown in Fig. 2. An intensive baking zone 102 with steam and a semi-intensive baking zone 104 is also shown. A conveyor belt 106 can hold the dough compositions and convey them into zone 1 with steam, then stage 2 and then exit the baking chamber. Oven vents 110 are also shown. Steam and/or air into the impingement oven can be introduced through nozzles 114.

In preferred embodiments, the proofed composition is sprayed with water prior to baking, and then steam baked in an impingement oven where the steam is

introduced through the air nozzles. This protocol, surprisingly, reduced the total baking time compared to a protocol that includes baking in conventional or convection ovens set at higher temperatures without pre-baking water spray.

The baking regimen for the dough products may include one or more stages. Preferably the baking regimen includes two stages, a steam-baking stage and a baking stage. The steam baking stage generally can develop the desired sheen, whereas the baking stage can develop the desired texture. Either one or more of the stages can include steam injection. The first stage preferably, contains baking in the presence of steam. Steam injection in the second stage, in addition to the first stage, may also be performed in some embodiments.

Each stage may include one or more zones in a baking chamber. Fig. 2, for example, shows one zone for each baking stage. Stage 1 may include for example, two zones in the baking chamber. In preferred embodiments, stage 1 and stage 2 each have one baking zone. When more than one zone is present in a stage, each zone can have the same or different environments.

In embodiments involving bagel-type products, the first stage preferably includes a steaming stage that is similar in result to boiling a conventional bagel. The second stage involves a baking stage, in which the dough products may be browned to the desirable color and further heated.

In preferred embodiments, the filled compositions are baked in two stages at two different temperatures. In embodiments using impingement ovens, the first stage. preferably, is at a lower temperature than the second stage. In preferred embodiments, the temperature in the first stage is between about 190°F and about 220°F and preferably between about 195°F and about 215°F and more preferably between about 200°F and

about 210°F. The temperature in the second stage can be between about 350°F and about 400°F and preferably between about 360°F and about 390°F and more preferably between about 370°F and about 380°F.

The amount of steam injection in the baking chamber can be reflected by the wet bulb temperature. The wet bulb temperature is the steady-state nonequilibrium temperature reached when a small amount of water is contacted under adiabatic conditions by a stream of gas. In other words, wet bulb temperature is a measure of the moisture and the energy content in an environment. The use of wet bulb temperatures is known in the art and can be determined by wet bulb thermometers. The wet bulb temperature in the first stage can be between about 185°F and about 200°F, preferably between about 190°F and about 195°F, more preferably between 165°F and about 175°F

The relative humidity, i.e. the amount of steam, in the baking chamber can also influence product development during baking. An increase in humidity in the first baking zone may increase the growth in length and width of the product while decreasing the height of the product. If the humidity is too high, the resulting product may be thin and wide causing nearby products to bake together in the oven.

The baking time for the dough compositions can be variable depending on the size of the product, the type of product, filling to dough ratio and the like. In embodiments of filled bagel products, the total bake time for the composition preferably is between about 3 minutes and 15 minutes. When baked in an impingement oven with steam injection in the first stage, the dough composition can preferably be baked between about 0.75 minute and about 3.5 minutes in stage 1 and more preferably between about 1 minute and about 2.5 minutes. In stage 2, the dough composition can

generally be baked between about 2 minutes and about 15 minutes, preferably between about 3 minutes and about 10 minutes and more preferably between about 3.5 minutes and about 5 minutes.

Air velocity at finger nozzle exit may, optionally, be directed at the dough composition in the baking chamber when using an impingement oven. Preferably the air velocity is directed vertically at the composition surface from above and below. The air velocity in stage 1 is preferably between about 50 feet per minute (fpm) and about 1000 fpm and more preferably between about 144 fpm and about 400 fpm. The air velocity in stage 2 is preferably between about 50 fpm and about 2000 fpm and more preferably between about 100 fpm and about 400 fpm.

Compression of the baked composition

After baking, the baked composition can be cooled prior to a preferred compression step to reduce the likelihood of the filling sticking to the belts in the compression unit and to reduce the variation in the height of the compressed product.

After cooling, the baked composition can be compressed to a desirable thickness. Generally, the baked composition is compressed such that it is not too thick to be reheated in a standard toaster. A dough product that is inappropriately thick may be too close to the coils in a toaster and burn upon reheating. In addition, an undesirably thick dough product may not be reheated adequately through its entire thickness in a toaster. The amount of compression can also be determined by the visual desirability to the consumers since a product that is too thin may not be desirable. Compression can also be performed to flatten a domed top surface.

The baked compositions can be cooled using a variety of cooling units or by being exposed to ambient temperature. Suitable cooling units include for example, a

spiral cooler, an impingement cooler and the like. Suitable cooling units are supplied for example by Frigoscandia Equipment, Redmond, WA., Northfield Freezing, Northfield, MN., and Triphase, West Yorkshire, U.K.

The appropriate temperature of the filling in the composition can determine in part, the propensity of the filling to leak out during the compression. Generally, the cooler the temperature of the filling the less likely the filling is prone to leak out. In some embodiments, the compression is performed when the filling is between about 80°F and about 190°F, preferably between about 150°F and about 160°F, and more preferably about 155°F. Compression may be performed at lower temperatures but the above mentioned range is particularly suitable when reduction in product height is of concern.

The baked composition can be placed onto a compression apparatus. Fig. 3 illustrates a suitable compression apparatus 300. The compression is generally performed by placing the baked composition between the top belt 304 and the bottom belt 306 in a compression apparatus. The gap 308 between the top belt 304 and bottom belt 306 is adjustable. In compression apparatus 300, the product flow is from right to left.

The compression apparatus preferably has an adjustable gap setting between the two belts. The two belts preferably contain a smooth surface such that the composition is not disrupted causing leakage of the filling. The compression may also include scraper blades and a wash unit to clean the two belts.

The baked composition is generally compressed to a thickness between about 10 mm and about 20 mmm, preferably between about 13 mm and about 17 mm and more preferably of about 15 mm.

The duration of the compression can vary and may determine the qualities of the compressed product. Generally the composition is compressed between about 10 seconds and about 60 seconds, preferably between about 25 seconds and 35 seconds.

Final product thickness can vary with gap setting but they generally differ depending on relaxation of the food product. The gap setting between the two belts is generally between about 20.0 mm and about 10.0 mm. Preferably, the gap between the two belts is gradually decreased as the composition travels between the two belts. A suitable compression unit, for example, may have a gap of about 20.0 mm at the entry point of the composition and the gap may be reduced to about 11.0 mm at the exit point.

In preferred embodiments, a second gap section may be included in the compression unit that has uniform gap between about 10.0 mm and about 14.0 mm. Thus, the composition can be first placed in the section with the decreasing gap setting and then into the section with the uniform gap setting.

Storage of filled dough product

The filled dough product, after compression can be stored. Storage generally involves refrigeration or freezing of the product. Refrigerated or frozen dough products can be stored for reasonable periods of time based on the storage temperatures. The refrigerated or frozen product can be reheated prior to eating, if desired.

The frozen or refrigerated filled dough product can be packaged for distribution to the consumer. Any suitable packaging can be used including conventional packaging. The consumer generally reheats the filled dough product, by baking, toasting or microwave heating the product. The filled dough products described

herein are particularly amenable to toaster reheating. Toaster cooking is a desirable approach from a consumer perspective due to convenience and speed.

EXAMPLES

Example 1 -Preparation of the dough

This example illustrates a method for preparing a dough to make the filled dough products described herein.

Yeast Slurry: The yeast slurry was made using 108 lb of water between about 100°F and about 110°F and 22.94 lbs of dry yeast. The slurry was agitated for a minimum of 10 minutes, but for not more than 30 minutes. The slurry was cooled to between about 55°F and about 70°F. The yeast slurry tank's contents were pumped up to the liquid slurry tank when this procedure was complete.

Water: A 100 lb quantity of water was added to the liquid slurry tank with the yeast slurry. Water, between about 40°F and 50°F, was automatically added to the tank based on weight. A 80 percent portion of the water was added first and then the final twenty percent was added after addition of ice.

Ice: A total of between about 238 lbs to about 253 lbs of ice was used. When the 238 lbs of ice was added to the liquid slurry tank with the yeast slurry and water, the mixture was too slushy to mix. This was remedied by adding only 188 lbs of ice to the slurry tank and front loading the remaining ice with the other ingredients into the dough mixer. After the ice and water were added to the slurry tank, the material in the slurry tank was transferred to a dough mixer.

Flour: 850 lbs of flour were front loaded into the dough mixer.

Malt: 46 lbs of malt was used. The malt was prewarmed to about 95°F and added to the liquid slurry tank.

High fructose corn syrup (HFCS): 61 pounds of syrup at about 95°F was added to the liquid slurry tank.

Buttermilk Vital Wheat Gluten Shortening: These ingredients were prescaled into a ziploc bag the day 5 before the run. The contents were added to each batch. 35.93 lbs of Vital Wheat Gluten, 24.464 lbs of shortening and 21.406 of buttermilk were used.

Datem, SSL Maturox Aziocarbonamide): These ingredients were prescaled into a ziploc bag the day before before the run. The contents were added to each batch. 2.75 lbs of DATEM, 0.31 lbs of Azodicaronamide, 3.06 lbs of SSL were used.

Salt: The salt was prescaled prior to each batch and front loaded after the 1st stage. 15.29 lbs of salt was used.

Mixing: The dough was mixed using a two-stage mix. Each stage consisted of 30 seconds of low speed mixing (32 rpm) and then the appropriate time for each stage as described below at high speed (64 rpm). The 1st stage ended one minute past peak. The average time to peak was about 15.5 minutes.

The salt was the only ingredient added for the 2nd stage mix. All other ingredients were put in for the 1st stage. The 2nd stage consisted of 2 minutes.

The liquid slurry, containing the yeast slurry, ice and water and other liquid ingredients, was pumped into a dough mixer. An Oshikiri horizontal bar mixer for 2000 lbs was obtained from Oshikiri, Japan and used here. The flour and all other dry ingredients were added except salt. The dough was mixed for about one minute past peak, about 16.5 minutes, at high speed. The salt was added to the mixer. The dough was mixed for two more minutes and emptied into a trough.

The dough had a temperature between about 66°F and 70°F. Results from farinograph testing of the dough indicated values between about 1000 BU and 1200 BU.

If the BU's are higher than 1200, water can be added to reduce the BU's to between about 1000 and about 1200. Results from extensigraph measurements show that extensibility was between about 180 and about 240. The R_{max} was between about 700 and about 1000. The R_5 was less than about 1000.

<u>Example 2 - Sheeting of the dough and the make-up table for preparing the raw filled dough composition</u>

This example illustrates a sheeting protocol for a dough prepared as in example 1 and a method for preparing a raw filled dough composition.

<u>Sheeting</u>

The sheeting line operated for a make-up table (MUT) rate of 52 fpm. If raisins were used (4.5% by weight), they were deposited by a Rademaker depositor. Dough thickness throughout the rollstands was assessed and recorded.

The following steps were involved in generating dough sheets. The dough was chunked and presheeted by passing the dough through a first set of rollers. The dough was passed through another set of rollers which is the 1st gauging station. Each gauging station contained a set of rollers. The dough was then scored, folded (enrobed), and passed through the second gauging station. The dough was then passed through a first multi roller and then a first lapper. The dough was then passed through a first pressure roller and second multi roller. The dough was then passed through a second lapper and a second pressure roller and third multi roller, and cross roller. The dough was then passed through the last four gauging stations.

Table 4 shows the thickness of the dough at various locations along the sheeting line.

TABLE 4

	DOUGH THICKNESS	
LOCATION	**mm**	**Inches**
After presheeting	32.5	1.28"
After 1st gauging station before folding (shortening area)	17.5	.693"
After folding and after 2nd gauging station	22.6	.893"
After multi roller #1	15.6	.612"
After lapper #1	54.3	2.13"
After multi roller #2	15.1	.595"
After lapper #2	52.7	2.1"
After multi roller #3	18.8	.74"
FINAL FOUR GAUGING STATIONS		
After #3.)	8.9	.35"
After #4.)	5.3	.21"
After #5.)	3.4	.135"
After #6.) final set of rollers	2.4	.094"

The MUT operated at 52 fpm for all tests. The dough pads for lanes 1, 4, 7, and 10 were strips cut at about 5.0 inches and remaining lanes at about 5.75 inches. Fillings were deposited using 3-strip spools. Table 5 shows the dimensions of the 3-strip spools used for depositing.

TABLE 5

All spools are 1.5" Dia.	**Inlet slot dimensions**	**Exit slot dimensions**
Cream cheese filling spool	1.75" long x .25" wide x 1.078 deep	1.5" long x .093" wide x .422 deep
Blueberry/Cinnamon spool	1.75" long x .25" wide x 1.078 deep	1.25" long x .08" wide x .422 deep

Filling deposit weights for lanes 1, 3, and 5 and product size and weight were measured and recorded at the MUT and shown below.

Forming Weights and 3 Sigma Range Targets.

Dough pad = 35.0 +/-4.0g (lanes 1, 4, 7, 10 only)

Water spray = 1.0 (+/- 0.5 g)

Blueberry filling = 8.5 (+/- 1.0g)

Cream cheese filling = 8.5 (+/- 1.0 g)

Total product = 53.0 +/-4.5 g (lanes 1, 4, 7, 10 only)

Table 6A, table 6B and table 7 show the depositing weights for the control configuration by lane; Table 6A shows blueberry filling, table 6B shows cream cheese filling and table 7 shows the total filling per product.

TABLE 6A

	Lane #1	Lane #4	Lane #7	Lane #10
	BB	BB	BB	BB
Average (g)	7.93	7.75	8.37	7.78
Std. Dev. (g)	0.367	1.41	0.56	0.371

TABLE 6B

	Lane #1	Lane #4	Lane #7	Lane #10
	CC	CC	CC	CC
Average (g)	9.4	9.01	9.49	9.59
Std. Dev. (g)	0.541	0.527	0.545	0.401

TABLE 7

	Lane #1	Lane #4	Lane #7	Lane #10
Average (g)	17.33	16.76	17.86	17.37
Std. Dev. (g)	0.654	1.505	0.781	0.546

After filling was deposited, a top sheet with venting slits was placed on the fillings. The compositions were crimped using smooth and rounded crimpers and then cut.

Example 3 - Proofing

This example illustrates proofing of the raw filled dough compositions.

The conveyor table removed products from the makeup table and placed them on the infeed belt for the proofer. The conveyor needed to allow spacing of products since products grow in width during proofing. Products cannot touch during proofing or they become deformed during the subsequent steps.

A variety of proofing conditions were examined with temperatures ranging between about 102°F and about 107°F, the time of proofing between about 25 minutes and about 36 minutes and with relative humidities of between about 45% and about 50%. Proofing conditions of 107°F at 50% relative humidity using a 30 minute dwell time provided the most desirable results in the most effective manner. Other conditions also resulted in appropriate products. A two zone single spiral proofer was obtained from Northfield Freezing, Northfield, MN. and used. The same conditions were used in both of the zones. Table 8 shows the fan speeds in each zone of the proofer. Table 9 shows the speed of the proofer belt with the corresponding residence time.

TABLE 8

Zone	Fan #1	Fan #1	Fan #1	Fan #1	Exhaust Fan	Exit Fan
1	30 Hz	30 Hz	30 Hz	30 Hz	45 Hz	30 Hz
2	30 Hz	30 Hz	30 Hz	30 Hz	45 Hz	30 Hz

TABLE 9

Residence (Min.)	26	28	30	33	26
Belt (FPM)	89	83	77	70	63

Table 10A, table 10B and table 10C show the data from the weight and temperature study throughout the proofing process. The count indicates the sample size.

TABLE 10A

		Proofer Inlet	
	Wt. (g)	DT (°F)	FT (°F)
Count	70	70	70
Average	51.7	55.4	58.1
St. Dev	2.57	1.81	1.82

TABLE 10B

		Proofer Midpoint	
	Wt. (g)	DT (°F)	FT (°F)
Count	36	36	36
Average	51.2	91.2	85.6
St. Dev	2.51	1.76	2.33

TABLE 10C

		Proofer Exit	
	Wt. (g)	DT (°F)	FT (°F)
Count	34	34	34
Average	50.3	92.1	88.7
St. Dev	2.62	1.31	1.48

Example 4 – Baking of the raw dough composition

This example illustrates a method for baking the raw filled dough composition.

Transfer to Oven

A transfer conveyor was used to bring the products from the proofing belt to the oven belt.

Surface Water Spray

A water spray of approximately 1.0 gram per product was used to increase the amount of moisture on the crust surface during baking. This amount of moisture created a fairly wet looking product. Water was applied through the use of a water spray.

Water spray facilitated crust sheen development in baking. The water spray occurred close to the oven. Otherwise the water was prone to soaking into the dough, making it more bready and dry.

Baking in rack ovens

The proofed composition was baked in pans in rack ovens. The rack ovens were Gemini rack ovens purchased from Gemini Bakery Equipment Co. in Philadelphia, PA. These rack ovens were equipped with dry coils for steam generation. Steam was generated when the steam button was pushed that resulted in 11 pounds of water being poured over the dry coils in 20 seconds to generate steam. Each side of a rack oven could hold 14 pans. The racks were rotated.

The oven was preheated to 550°F. The pans were inserted in the racks, the door closed and the steam added. The dough compositions were baked with steam

for about 40 seconds. The temperature was then changed to 400°F and the dough compositions were baked for about an additional 9-10 minutes until sufficient color and texture had been attained.

Continuous/Panless Baking

During panless baking, products were continuously conveyed directly on a belt through a linear multizone impingement oven with steam injection. The Enerjet™ impingement oven with intensive bake configuration and steam injection through the air nozzles was used in the first stage. The second stage was a semi-intensive non-steam bake configuration.

The two stage baking regimen was used. The following conditions were used for baking.

stage 1 time = 1.25 minutes

stage 1 temperature setting = 200°F

stage 1 damper = 50/50 top/bottom air flow

stage 1 fan setting = 3

stage 2 time = 4.75 minutes

stage 2 damper = 50/50 top/bottom air flow

stage 2 fan setting = 4

Color of the product was controlled by changing the stage 2 temperature. Sheen was controlled by changing the steam pressure into the oven in stage 1. The pressure readings were taken from the last pressure gauge before the steam enters the oven in zone 1. A stage 2 temperature of 375°F and steam pressure in stage 1 of between about 25 psi and about 30 psi produced a product with high sheen and desirable color. A stage 2 temperature of 385°F and steam pressure in stage 1 of between about

8.5 psi to about 11.5 psi produced a product of low sheen and desirable color. A 20°F setting change in the stage 2 temperature was needed to see a noticeable change in the color.

Example 5 - Compression of the baked composition

This example illustrates compression of the baked composition to the desired thickness following baking and the amount of filling leakage during compression.

The compositions from the oven were cooled at room temperature to a target core temperature range of about 155°F. Compression was performed using a APV compression unit with parchment paper over the products. The parchment paper was only necessary to measure the amount of filling leakage and unnecessary for the compression process. All of the parchment paper was zeroed out prior to compression. All of the parchment paper was collected after compression and weighed to determine the amount of filling that transferred from the products. The products had a vent width of about 1.425 inches or about 0.95 inches. Compression was performed using a gap of about 13 mm for about 15 seconds.

The filling leakage was reduced by 54% when using vents that are 0.95 inches instead of 1.425 inches for products baked in the rack ovens. There was no leak out for products with 0.95 inches vent widths baked in an impingement oven. Using this information, vent widths between the ranges of about 0.95 inches and about 1.2 inches appear to produce desirable results. The compressed filled dough product was ready for packaging and storage.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A baked filled dough product comprising a yeast leavened dough holding a filling, the baked filled dough product having a thickness of between about 10 millimeters and about 20 millimeters.

2. The dough product of claim 1, wherein the thickness of the dough product is between about 12 mm and about 18 mm.

3. The dough product of claim 1, wherein the crust of the dough product has a dense, chewy texture and sheen.

4. The dough product of claim 1, wherein the dough product is formed from a yeast leavened raw dough, the raw dough prior to leavening having a farinograph reading of between about 1000 BU and about 1200 BU.

5. The dough product of claim 1, wherein the dough crust of the dough product is fat free.

6. The dough product of claim 1, wherein the fat content of one serving of the dough product is about 3 grams or less.

7. The dough product of claim 1, wherein the fat content of one serving of the dough product is between about 1.5 grams and about 2.5 grams.

8. The dough product of claim 1, wherein the filling has a water activity of between about 0.79 and about 0.9.

9. The dough product of claim 1, wherein the filling has a water activity of between about 0.82 and about 0.84.

10. The dough product of claim 1, wherein the filling is selected from the group consisting of a fruit filling, a cream cheese filling, a cinnamon filling, and mixtures thereof.

11. The dough product of claim 10, wherein the fruit filling is a blueberry filling.

12. The dough product of claim 10, wherein the fruit filling is a strawberry filling.

13. The dough product of claim 1, wherein the filling comprises a fruit filling and a cream cheese filling.

14. The dough product of claim 1, wherein the filling comprises cinnamon filling and a cream cheese filling.

15. The dough product of claim 1, wherein the filling has a viscosity of between about 100,000 cps to about 400,000 cps at a shear rate of 1 rpm.

16. The dough product of claim 1, wherein the filling has a viscosity of between about 175,000 cps to about 350,000 cps at a shear rate of 1 rpm.

17. A method of making a dough product comprising;

baking a raw dough composition without restraints, the dough comprising flour, water and an active yeast culture; and

compressing the baked dough composition to form the dough product.

18. The method of claim 17, wherein the dough product is a filled dough product and the baking is of a raw filled dough composition comprising a filling held within the dough.

19. The method of claim 17, wherein one serving of the dough product has a fat content of 3 grams or less.

20. The method of claim 17, wherein the dough product has a thickness between about 10 mm and about 20 mm.

21. The method of claim 17, wherein the dough product has a thickness between about 12 mm and about 18 mm.

22. The method of claim 17, further comprising proofing the raw dough composition prior to baking.

23. The method of claim 17, wherein the raw dough composition has been sprayed with sufficient water prior to baking to develop sheen.

24. The method of claim 17, wherein the baking is done in the presence of steam.

25. The method of claim 17, wherein the baked composition is cooled prior to compressing.

26. The method of claim 17, wherein the dough further comprises particulate matter.

27. The method of claim 26, wherein the particulate matter is raisins.

28. The method of claim 18, wherein thc method for making the raw filled dough composition comprises;

sheeting a dough to produce a top dough sheet and a bottom dough sheet, the dough comprising flour, water and an active yeast culture that have been mixed together, the top dough sheet having venting openings within;

depositing a filling on the bottom dough sheet;

placing the top dough sheet on top of thc bottom dough sheet; and crimping and cutting to form the raw filled dough composition.

29. The method of claim 28, wherein the dough has farinograph measurement between about 1000 BU and 1200 BU.

30. The method of claim 28, wherein the filling comprises a fruit filling, a cream cheese filling, a cinnamon filling and mixtures thereof.

31. The method of claim 28, wherein the filling is deposited in a strip pattern.

32. The method of claim 28, wherein the filling is deposited in a band pattern.

33. The method of claim 28, wherein the filling is deposited in a three strip pattern, wherein the outer strips are selected from the group consisting of a fruit filling and a cinnamon filling and the center strip is a cream cheese filling.

34. The method of claim 28, wherein the filling is deposited in a band pattern, wherein the bottom band is selected from the group consisting of a fruit filling and a cinnamon filling and the top band comprises a cream cheese filling.

35. The method of claim 28, wherein the filling has viscosity, at a shear rate of 1 rpm of between about 100,000 cps and about 400,000 cps.

36. The method of claim 28, wherein the filling has viscosity, at a shear rate of 1 rpm of between about 175,000 cps and about 350,000 cps.

37. The method of claim 28, wherein the filling stays substantially within the crust during compression.

38. A dough product made according to the method of claim 17.

39. A dough product made according to the method of claim 18.

40. A dough product made according to the method of claim 28.

41. A method for making the raw filled dough composition comprising;

sheeting a dough to produce a top dough sheet and a bottom dough sheet,

the dough comprising flour, water and an active yeast culture that have been mixed together, the top dough sheet having venting openings within;

depositing a filling on the bottom dough sheet;

placing the top dough sheet on top of the bottom dough sheet; and

crimping and cutting to form the raw filled dough composition.

42. The method of claim 41, wherein the dough has a farinograph measurement of between about 1000 BU and about 1200 BU.

43. The method of claim 41, wherein the dough has a farinograph measurement of between about 1050 BU and about 1150 BU.

44. The method of claim 41, wherein the sheeting comprises rolling steps, enrobing steps and lapping steps.

45. The method of claim 41, wherein the bottom dough sheet is sprayed with water prior to placement of the top dough sheet.

46. The method of claim 41, wherein the top and bottom dough sheets are dedusted.

47. The method of claim 41, wherein the filling is spot-deposited intermittently such that the filling is centered in the dough composition when cut and crimped.

48. A method of making a dough product comprising baking the dough product in an impingement oven with air nozzles wherein steam is injected in one or more zones of the impingement oven through the air nozzles.

49. The method of claim 48, wherein a baking regimen for baking the dough product comprises a stage of steam baking, wherein the steam baking is conducted at wet bulb temperatures of between about 185°F and about 200°F.

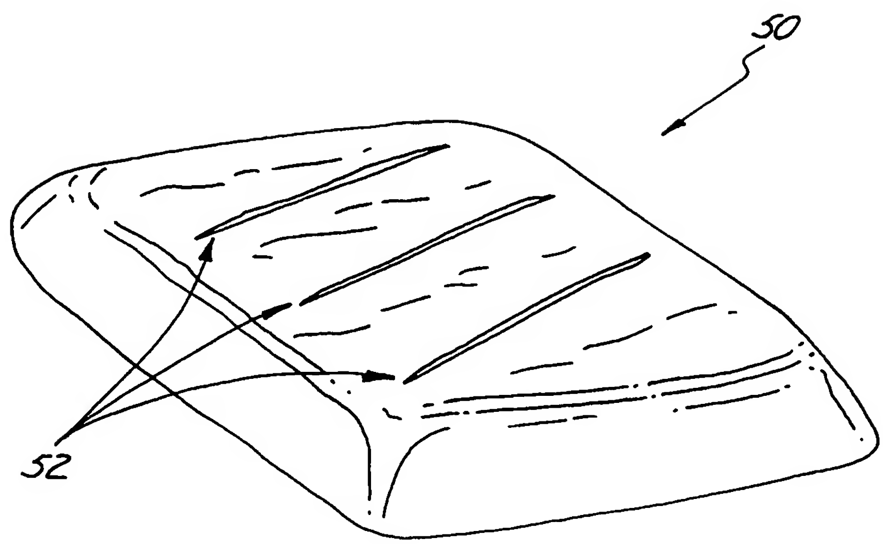

Fig. 1

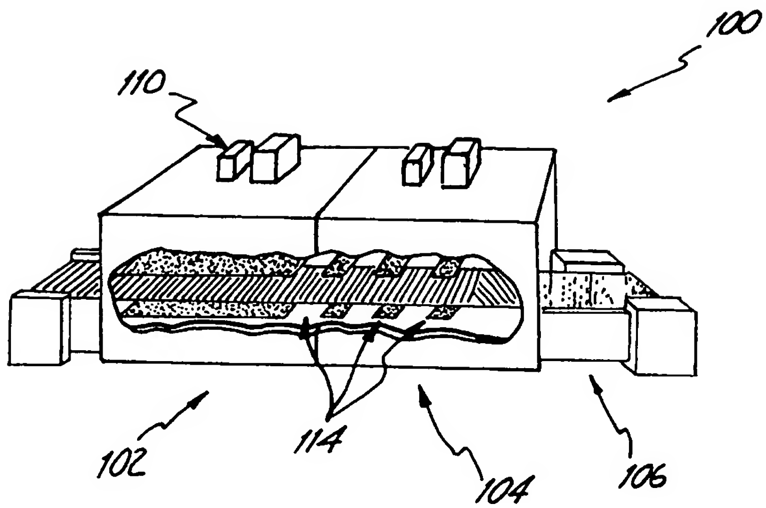

Fig. 2

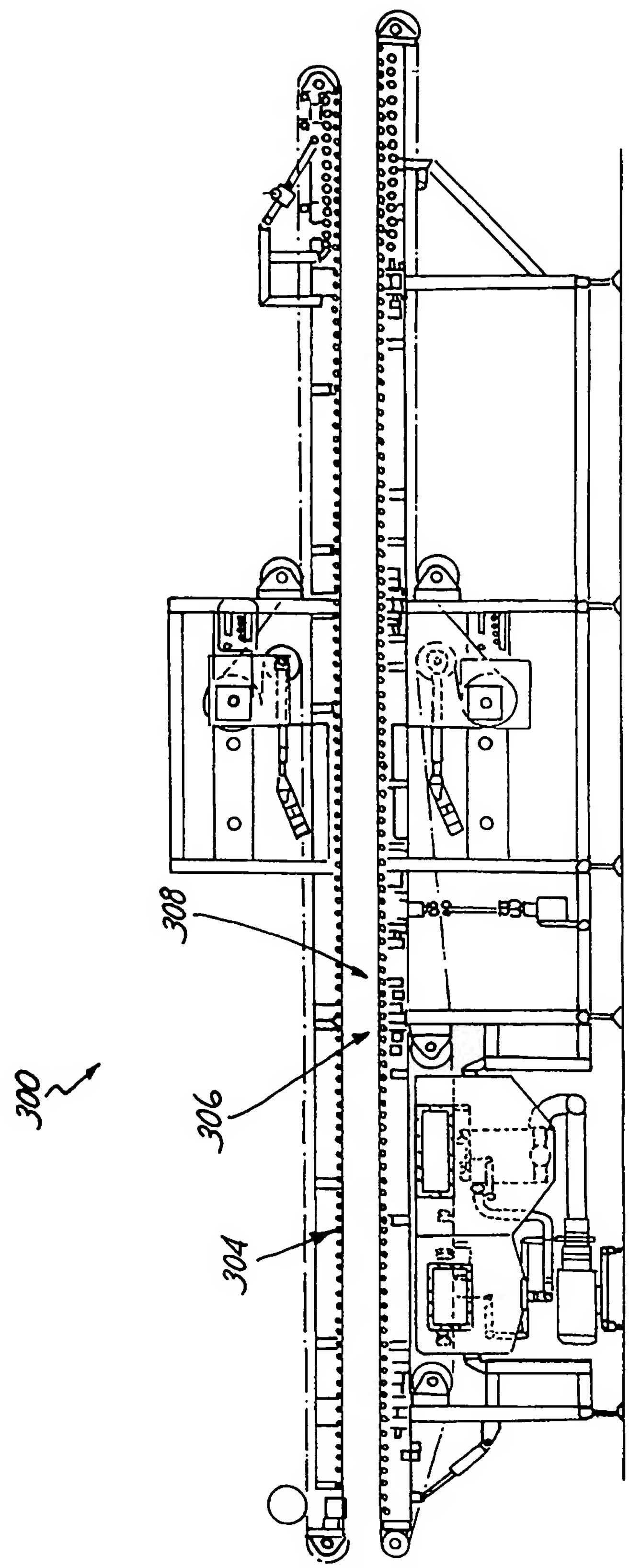

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/30081

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A21D13/00 A23G3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A21D A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y		8,9, 15-18, 20,21, 25,28, 30, 37-40, 46,47
A		4-7,19, 26,27, 29,42,43

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 February 2001	06/03/2001

Name and mailing address of the ISA	Authorized officer
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International Application No
PCT/US 00/30081

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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